AMENDED CLAIMS

[Received by the International Bureau on 16 November 2004 (16.11.04): original claims 1 and 4 amended; new claim 21-24 added; remaining claims unchanged;(4 pages)]

1. A rotary device for use with compressible fluids, the device comprising:

a first rotation element mounted to rotate about a first axis;

a casing having a surface enclosing at least a part of the first rotation element, an elongate cavity of varying cross sectional area being defined between a surface of the first rotation element and the casing surface; and

a plurality of second rotation elements mounted to rotate about respective second axes, each second rotation element being mounted to project through a slot in the casing surface and to cooperate with the first rotation element surface so as to divide the cavity into adjacent working portions, at least one working portion being a closed volume defined at opposite ends by adjacent second rotation elements for a part of a cycle of the device, the volumes of the working portions varying as the first and second rotation elements rotate,

wherein each second rotation element comprises a number of projecting portions of varying radius about the respective second axis so that each projecting portion projects into the cavity through the slot in the casing by a varying amount to cooperate with the first rotation element surface.

2. The device of claim 1, wherein each projecting portion of a second rotation element spans an angle about the respective second axis, the radius of the projecting portion constantly varying about the axis.

3. The device of claim 1, wherein each projecting portion of a second rotation element spans an angle about the respective second axis, the radius of the projecting portion stepping about the axis.

4. The device of claim 3, wherein projecting portions of each second rotation element only partially project through a respective slot at any time during rotation of the first and second rotation elements.

5. The device of claim 4, wherein a maximum angle spanned by a slot about a respective second axis is smaller that the angle spanned by projecting portions of each second rotation element.

6. The device of any one of the preceding claims, wherein the first rotation element surface is a cylindrical surface.

7. The device of claim 6, wherein the first rotation element is internal to the casing surface and the second rotation elements are external to the casing surface.

8. The device of claim 6, wherein the first rotation element is external to the casing surface and the plurality of second rotation elements are internal to the casing surface.

9. The device of any one of claims 1 to 5, wherein the first rotation surface is an end surface.

10. The device of any one of the preceding claims, wherein the device is a rotary compressor or rotary expander, rotation of the first and second rotation elements causing the volume of the working portions of the cavity to reduce or increase during rotation of the first and second rotation elements.

11. The device of any one of claims 1 to 10, wherein the device is a rotary engine, the device performing compression followed by expansion, rotation of the first rotation element and the plurality of second rotation elements causing the volume of the working portions of the cavity to reduce and then increase during rotation of the first and second rotation elements.

12. The device of claim 11, further comprising ignition means for ignition of a compressed fluid prior to expansion.

13. The device of any one of the preceding claims, wherein the first rotation element further comprises at least one passage for fluid inlet and/or fluid outlet.

14. The device of any one of the preceding claims, wherein the casing further comprises a number of valves, each valve being operative as a fluid inlet or fluid outlet only when adjacent to a working portion of the cavity, and wherein each valve is only adjacent to a working portion of the cavity during a fraction of a cycle of the device.

15. The device of claim 14, wherein each valve is never adjacent to a lowest volume working portion of the cavity during a cycle of the device, thereby avoiding contact between valves and highest pressure fluids.

16. The device of claim 14 or 15, wherein each of the at least one valves is operative to vary the flow rate of a fluid into a working portion of the cavity, to vary the pressure of fluid within a working portion of the cavity, or to vary a compression and/or expansion ratio of the device.

17. The device of any one of claims 14 to 16, wherein closed loop feedback control is used to control the operation of each of the at least one valves, the closed loop feedback control being based on at least one device operating parameter.

18. The device of claim 17, wherein the at least one device operating parameter comprises at least one of fluid inlet pressure, fluid outlet pressure and rotary speed.

19. The device of any one of the preceding claims, wherein the second rotation elements are distributed about the first rotation element, each second rotation element being mounted to rotate about a respective second axis that is perpendicular to the first axis.

20. The device of any one of the preceding claims, wherein the first rotation element surface and the casing surface further define a seal between working portions of the cavity.

21. The device of any preceding claim, wherein the part of the cycle of the device during which at least one working portion is a closed volume defined at opposite ends by adjacent second rotation elements includes a part of the cycle during which the working portion experiences compression.

22. The device of claim 21, wherein the part of the cycle of the device during which at least one working portion is a closed volume defined at opposite ends by adjacent second rotation elements includes a part of the cycle during which the working portion experiences maximum compression.

23. The device of claim 21 or 22, wherein the part of the cycle of the device during which at least one working portion is a closed volume defined at opposite ends by adjacent second rotation elements further includes a part of the cycle during which the working portion experiences expansion.

24. The device of claim 24, wherein the adjacent second rotation elements that define opposite ends of at least one working portion are the same second rotation elements for the parts of the cycle during which the working portion experiences compression and expansion.